SPEC No. LD-6801A 查询LQ 10D131供应商 DATE FILE No. SHAR ISSUE: Aug. 31, 1994 16 pages APPROVED BY: PAGE : DATE APPLICABLE GROUP LIQUID CRYSTAL DISPLAY GROUP SHARP CORPORATION Liquid Crystal Display Group SPECIFICATION DEVICE SPECIFICATION FOR TFT-LCD module MODEL No. LQ10D131 CUSTOMER'S APPROVAL DATE PRESENTED, & Kucker

ΒY

Department General Manager Engineering Department 2 TFT LCD Development Center LIQUID CRYSTAL DISPLAY GROUP

SHARF CORPORATION

4. Input Terminals

4-1, TFT-LCD panel driving

CN1 (Interface signals)

Used connector:DF9L-31P-1V (Hirose Electric Co., Ltd.)
Corresponding connector:DF9 -31S-1V (")

DF9A-31S-1V (")

| Pin No. | Symbol | Function | Remark |
|---------|------------|---|---------|
| 1 | RO | RED data signal (LSB) | |
| 2 | GND | | |
| 3 | R1 | RED data signal | · |
| 4 | Vsync | Vertical synchronous signal | [Note]] |
| 5 | R2 | RED data signal | |
| 6 | Hsync | Horizontal synchronous signal | [Notel] |
| 7 | R3 | RED data signal (MSB) | |
| 8 | GND | | |
| 9 | GND | | |
| 10 | CK | Clock signal for sampling each data signal | |
| 11 | G 0 | GREEN data signal (LSB) | |
| 12 | GND | | |
| 13 | G1 | GREEN data signal | |
| 14 | TST | This should be electrically opened during operation | |
| 15 | GND | | |
| 16 | TST | This should be electrically opened during operation | |
| 17 | G2 | GREEN data signal | |
| 18 | TST | This should be electrically opened during operation | ATT |
| 19 | G3 | GREEN data signal (MSB) | |
| 20 | GND | | |
| 21 | GND | | |
| 22 | Vcc | +5V power supply | |
| 23 | B0 | BLUE data signal (LSB) | |
| 24 | Vcc | +5V power supply | |
| 25 | B1 | BLUE data signal | |
| 26 | TST | This should be electrically opened during operation | |
| 27 | GND | | |
| 28 | ENAB | Data enable signal | [Note2] |
| 29 | B2 | BLUE data signal | |
| 30 | GND | | |
| 31 | В3 | BLUE data signal (MSB) | |

★The shielding case is connected with GND.

[Note]] 480 line. 400 line or 350 line mode is selected by the polarity combination of the both synchronous signals.

| | mode | 480 lines | 400 lines | 350 lines |
|---|-------|-----------|-----------|-----------|
| ì | Hayne | negative | negative | positive |
| | Vayne | negative | positive | negative |

[Note2] The horizontal display start timing is settled with a rising timing of this signal. In case ENAB is fixed "Low", the horizontal start timing is determind in the module. (refer to 7-2) Don't use ENAB signal fixed "High".

RECORDS OF REVISION

| SPEC No. | DATE | REVISED No. | PAGE | SUMMARY | NOTE |
|----------|---------------|----------------|---|---|---|
| LD-6801 | _ | | | | 1 st Issue |
| LD-6801A | SEP. 22. 1994 | A | 2 | 4. Input Terminals [Note2] (added) | 2 nd Issue |
| | .,,,,, | | 11 | 9. Optical Characteristics | |
| | | .,,,,,, | ********* | Luminance of white(Y _t) Min. 50 cd/m ² | (added) |
| | | | | | William Control |
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1. Application

This specification applies to color TFT-LCD module. LQ10D131.

2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs. control circuit, power supply circuit and a backlight unit. Graphics and texts can be displayed on a 640x3x480 dots panel in 4.096 colors by supplying 12 bit data signal, four timing signals, +5V DC supply voltage for TFT-LCD panel driving and supply voltage for backlight. Optimum viewing direction is 6 o'clock.

The 400 line and 350 line modes in addition to the 480 line modes can be also applied for this module.

Backlight-driving DC/AC inverter is not built in this module.

3. Mechanical Specifications

| Parameter | Specifications | Unit |
|----------------------------|--|---------|
| Display size | 26 (10.4°) Diagonal | СШ |
| Active area | 211. 2(H) × 158. 4(V) | THE STA |
| Pixel format | 640(H) × 480(V) | pixels |
| | (1 pixel = R + G + B dots) | |
| Pixel pitch | 0.33(H) × 0.33(V) | יות מו |
| Pixel configuration | R.G.B vertical stripe | |
| Display mode | Normally white | |
| Unit outline dimensions *1 | 242.5(W)×179.4(H)×11.5(D) | តា៣ |
| Weight | 500±10 | g |
| Surface treatment (Haze) | Anti-glare and hard-coating 2H (25*5) | (%) |
| | And the second s | |

^{*1.} With the exception of the backlight connector electric parts and rear cover.

Outline dimensions is shown in Fig. 1

4-2. Backlight driving

Used connector : BHR-03VS-1(JST)

CN2

Corresponding connector:SM02(8.0)B-BHS(JST)

| Pin no | . symbol | function |
|--------|----------|---|
| 1 | V night | Power supply for lamp (High voltage side) |
| 2 | | This is electrically opened. |
| 3 | VLow | Power supply for lamp (Low voltage side) |

5. Absolute Maximum Ratings

| Parameter | Symbol | Condition | Rati | ngs | Unit | Remark |
|---------------------------------|--------|-----------|---------------|---------|------|---------|
| Input voltage | V t | Ta=25℃ | -0.3 ~ | Vcc+0.3 | V | [Notel] |
| +5V supply voltage | Vcc | Ta=25₹ | 0 ~ | + 7 | V | |
| Storage temperature | Tstg | | − 25 ~ | + 60 | °C | [Note2] |
| Operating temperature (Ambient) | Topa | | 0 ~ | + 50 | ℃ | |

[Notel] CK. RO-R3, GO-G3, BO-B3, Hsync, Vsync, ENAB

[Note2] Humidity: 95%RH Max. at Ta≤407.

Maximum wet-bulb temperature at 39% or less at Ta>40%.

No condensation.

6. Electrical Characteristics

6-1. TFT-LCD panel driving

Ta = 25°C

| | Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-------------------|---------------------------------------|------------------|------|-------|-------|-------|---------------------|
| + 5V | Supply voltage | Vcc | +4.5 | +5. O | +5. 5 | V | [Note1] |
| _ | Current dissipation | Icc | _ | 200 | 500 | m A | [Note2] |
| Permi | Permissive input ripple voltage | | | _ | 100 | mVp−p | Vçç |
| | voltage (Low) | V ₁ L | | | +1.5 | V | Vcc=+5V |
| | voltage (High) | V 1.8 | +3.5 | - | | V | [Note3] |
| | current (low) | Iot | _ | | 1.0 | μΑ | V 1 = 0 V |
| # · · · p · · · · | | | | | | | [Note3] |
| Inout | current (High) | Ioni | _ | _ | 1.0 | μА | V ₁ =Vcc |
| input | · · · · · · · · · · · · · · · · · · · | | | | | | [Note4] |
| | • | Тона | 417 | | 60.0 | μА | V = VCC |
| | | _ | | | | | [Note5] |

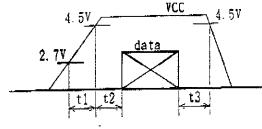
[Note1]

Vcc-turn-on conditions

t1≤10ms

0<t2≦10ms

t3>0ms



td

Vcc-dip conditions

1) 2.7V \leq Vec \langle 4.5V td \leq 10ms

2) Vcc < 2.7V

Vcc-dip conditions should also follow the Vcc-turn-on conditions

[Note2] Typical current situation : Black pattern. (at 480 line mode, Vcc=+5.0V)

[Note3] CK. RO-R3. GO-G3. BO-B3. Hsync. Vsync. ENAB

[Note4] CK. RO-R3, GO-G3, BO-B3, Hsync. Vsync

[Note5] ENAB

6-2. Backlight driving

The backlight system is an edge-lighting type with single CCFT(Cold Cathode Fluorecent Tube).

The characteristics of single lamp are shown in the following table.

Ta=25℃

VCC

| Parameter | Symbol | Min. | Тур. | Max. | Unit | Remark |
|------------------------|----------------|-------|------|------|-------|--------------------|
| Lamp voltage | V 1. | - | 540 | _ | Vrms | Just for reference |
| Lamp current | I. | 2. 5 | 3. 7 | 4.5 | mArms | [Notel] |
| Lamp power consumption | P. | _ | 2. 0 | _ | W | [Note2] |
| Lamp frequency | F | 20 | - | 60 | kHz. | [Note3] |
| Kick-off voltage | V _s | | _ | 1100 | Vrms | Ta=250 |
| made ora :- wite- | | _ | | 1300 | Vrms | Ta=0't |
| Lamp life time | L, | 10000 | _ | _ | h | [Note4] |

- [Notel] Available current range considering light-adjustment.
- [Note2] Calculated value for reference. (I.XV.)
- [Note3] Lamp frequency may produce interference with horizontal synchronous frequency, and this may cause beat on the display. Therefore lamp frequency shall be detached as much as possible from the horizontal synchronous frequency and its harmonics to avoid interference.
- [Note4] Brightness becomes 50% of the original value under standard condition. $(I_{1}=3.7 mArms)$
 - Note) The turn-on characteristics and the life of the backlight depend greatly on the inverters characteristics as a power source. Before you order the inverters from vendors make sure that the ill-lighting like flickering not-being-turned-on or else will not occur because of the un-adjustment between the inverter and the backlight. It is recommended that the trial conditions for above confirmation should be as close to the practical situation as they can be.

Timing Characteristics of input signals
 Input signal waveforms are shown in Fig. 2-①~③.

7-1 Timing characteristics

| Paras | neter | Symbol | Mode | Min. | Тур. | Max. | Unit | Remark |
|------------------|---|--------|------|-------|----------|--------|-------|--------|
| Clock | Frequency | 1/Tc | a11 | _ | 25. 18 | 28. 33 | MHz | |
| | High time | Tch | , | 5 | | _ | лѕ | |
| | Low time | Tcl | , | 10 | | | ns | |
| Data | Setup time | Tds | H | 5 | | | ns | |
| | Hold time | Tdh | 'n | 10 | - | _ | л\$ | |
| Horizontal | Cycle | TH | • | 30.00 | 31. 78 | | μS | |
| sync. signal | | | * | 770 | 800 | 900 | clock | |
| | Pulse width | THp | 7 | 2 | 96 | 200 | clock | |
| Vertical | Cycle | TV | 480 | 515 | 525 | 560 | line | |
| sync. signal | - | | 400 | 445 | 449 | 480 | line | |
| | ļ | | 350 | 447 | 449 | 510 | line | |
| | Pulse width | TVp | all | 2 | - | 34 | line | |
| Horizontal di | splay period | THd | 7 | 640 | 640 | 640 | clock | |
| Hsync-Clock | | THc | .n | 10 | | Tc-10 | ns | , |
| phase difference | | | | | <u>,</u> | | | , |
| Hsync-Vsync | , | ΤVh | 4 | 0 | _ | TH-THp | กร | |
| phase differe | nce | | | | | | | |

Note) In case of lower frequency, the deterioration of display quality, flicker etc., may be occured.

7-2. Horizontal display position and Data enable signal
Horizontal display position is setlled by data enable signal, horizontal display
starts from rising of the data enable signal.

Timing characteristics

| Parame | ter | Symbol | Mode | Min. | Typ. | Max. | Unit | Remark |
|---------------|-------------|--------|------|------|------|-------|-------|--------|
| Enable signal | Setup time | Tes | all | 5 | _ | Tc-10 | ns | |
| | Pulse width | Tep | v | 2 | 640 | 640 | clock | |
| Hsync-Enable | signal | THe | n | 44 | | 164 | clock | |
| phase differe | nce | | | | } | | | |

Note) If data enable terminal (ENAB) is fixed "Low", the display starts from the data of C104(clock) as shown in Fig. 2-0-0.

7-3. Vertical display position

If sinc, signals have the polarity discribed in 4-1 (Notel) and have values shown in the following table, the vertical display position is automatically centered at each mode of VGA: 480 line, 400 line and 350 line.

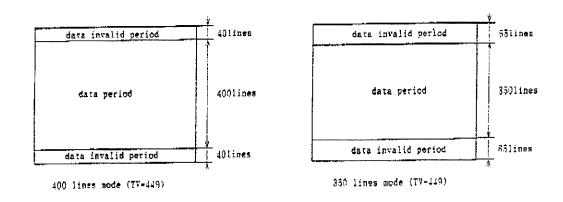
In 400 and 350 line modes, the display position will not be centered on the screen if the cycle of vertical synchronous signal. TV, deviates from typical values.

The data enable signal has no relation to the vertical display position.

| node | V-data start(TVs) | V-data period(TVd) | V-display start | V-display period | Unit | Remark |
|------|-------------------|--------------------|-----------------|------------------|------|--|
| 480 | 34 | 480 | 34 | 480 | line | |
| 400 | 34 | 400 | 443-TV | 480 | line | [Note1] |
| 350 | 61 | 350 | 445-TV | 480 | 1ine | . 1 . 16 4 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 |

[Note1] Since the data in the vertical data invalid period is displayed in 400 and 350 line modes, inputting all data "0" is recommended during vertical data invalid period.

(refer to the following figure)



7-4. Input Data Signals and Display Position on the screen

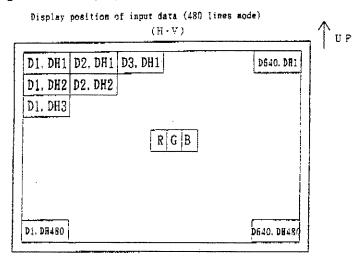
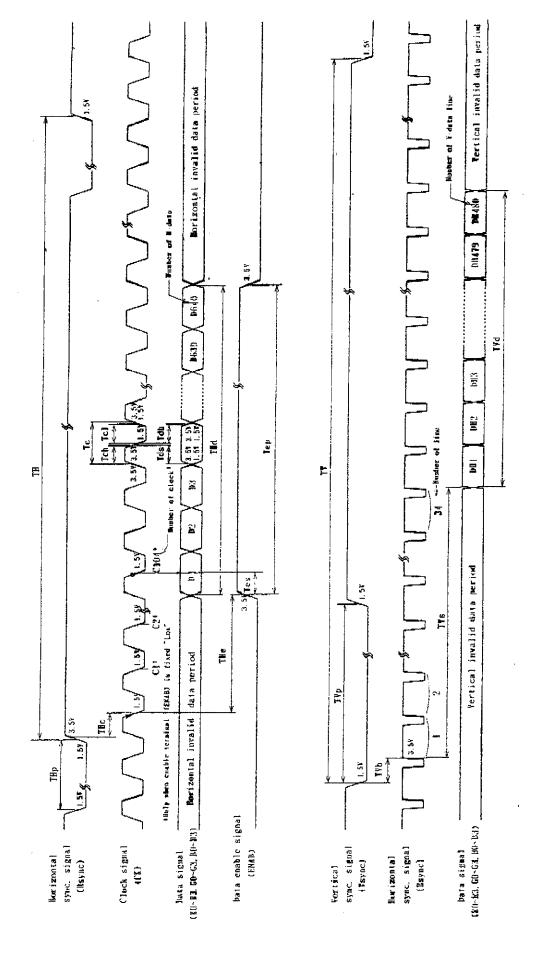




Fig. 2-(# Imput signal waveforms (480 line mode)



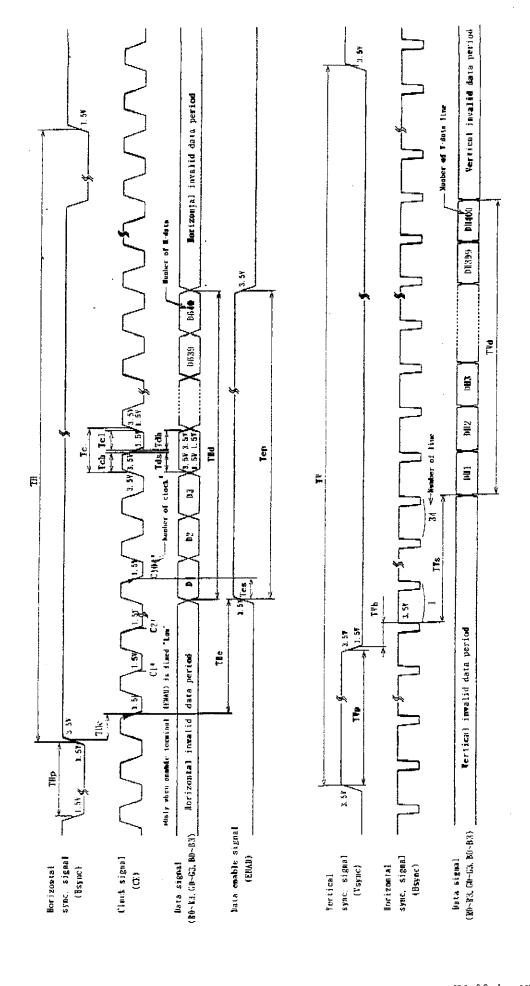
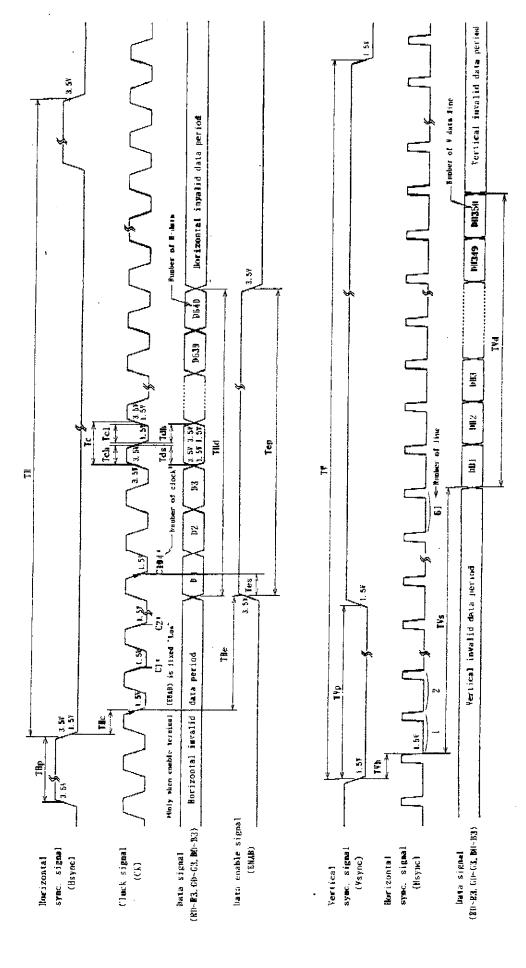


Fig. 2-¢ Input signal maveforms (400 line mode)



Pig. 2-♦ Input signal waveforms (350 line mode)

0: Low level voltage
1: High level voltage

8. Input Signals. Basic Display Colors and Gray Scale of Each Color

| | Color & | [| | | Dat | a sig | nal | | | •••• | | | |
|---------------------|------------|----|----|----------|-----|-------|-----|------------|-----|------|-----|-----|-----|
| | Gray scale | RO | RŢ | R 2 | R 3 | GO | G1 | G 2 | G 3 | В0 | B 1 | B 2 | B 3 |
| | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| 1 5 | Green | 0 | 0 | 0 | 0 | 1. | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| color | Light blue | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Basic | Purple | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Black | 0 | 0 | 0 | . 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Red | Û | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0f 1 | Darker | 0 | 1 | 0 | O | 0 | 0 | 0 | 0 | 0 | Q | 0 | 0 |
| | Û | | | 1 | | į. | | | | | • | | . |
| Gray Scale | Û | | | · | | | | | | | , | | |
| S === | Brighter | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gra | Û | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| G | Û | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gray Scale of Green | Darker | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| of G | Û | | | ‡ | | į | | | | | | | |
| 3 le | Û | | | Į | | | į | | | 1 | | | |
| သ | Brighter | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| ray | Û | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 5 | Green | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blue | Û | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| £ 1 | Darker | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 6 | Û | | , | | ĺ | į | | | | • | | | |
| 3 | Û | | | , | | | | | | 1 | | | |
| S | Brighter | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| Gray Scale of | Û | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |

Each color is displayed in 16 gray scales from 4 bit data signals input. According to the combination of total 12 bit data, 4.096 colors are displayed.

9. Optical Characteristics

Ta=25°. Vcc=+5V

| Parameter | | Symbol | Condition | Win. | Typ. | Max. | Unit | Remark |
|--------------------|------------|-------------|-----------------------|------|--------|-------|-------|------------|
| Viewing | Horizontal | θ 21. 22 | CR > 10 | 3 5 | - | _ | Deg. | [Notel. 4] |
| angle range | Vertical | <i>θ</i> 11 | | 10 | _ | | Deg. | |
| | | <i>e</i> 12 | | 3 0 | - | - | Deg. | |
| Contrast ratio | | CR | Options viewing angle | 6.0 | _ | A | | [Note2.4] |
| Response time | Rise | rr- | | _ | 3 0 | | ms | [Note3.4] |
| | Decay | τd | | _ | 50 | | ns | |
| Chromaticity of | | × | θ=0° | _ | 0.313 | _ | | [Note4] |
| white | | у | | _ | 0. 329 | _ | | |
| Luminance of white | | Υι | | 50 | 70 | - | cd/m² | |
| White Uniformity | | δw | | _ | - : | 1. 45 | | [Note5] |

 \Re The measurement shall be executed 15~20 minutes after lighting at rating. The optical characteristics shall be measured in a dark room or equivalent state with the method shown in Fig. 3 below. (I_L=3.7mArms)

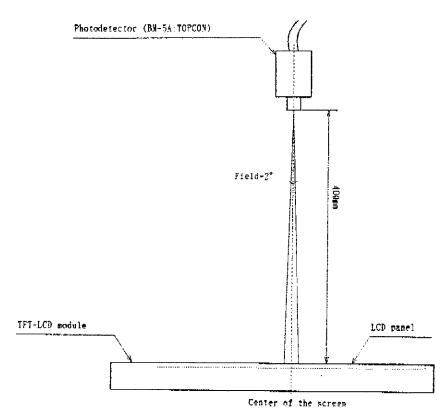
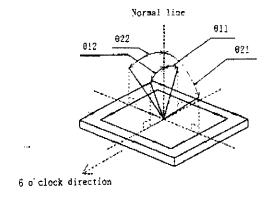


Fig. 3 Optical characteristics measurement method

[Notel] Definitions of viewing angle range:



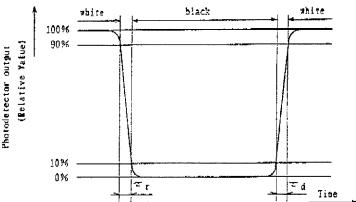
[Note2] Definition of contrast ratio:

The contrast ratio is defined as the following.

Contrast Ratio (CR) = Luminance (brightness) with all pixels white Luminance (brightness) with all pixels black

[Note3] Definitions of response time:

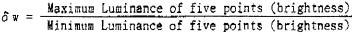
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

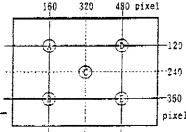


[Note4] This shall be measured at center of the screen.

[Note5] Definition of white uniformity:
White uniformity is defined as the

following with five measurements (A~E).





10. Display Quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

. 11. Handling Precautions

11-1. Be sure to turn off the power supply when inserting or disconnecting the cable.

11-2. Others

- a) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- b) Since the front polarizer is easily damaged, pay attention not to scratch it.
- c) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
- d) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- e) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
- f) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling.
- g) Observe all other precautionary requirements in handling components.
- h) This module has its circuitry PCBs on the rear side and should be carefully handled in order not to be stressed.
 - Otherwise possibility occurs that some of the components are damaged.

12. Packing form

- a) Piling number of cartons: MAX.7
- b) Package quantity in one carton: MAX. 10
- c) Carton size : 413(\)x288(H)x351(D)mm
- d) Total mass of 1 carton filled with full modules: 7000g Packing form is shown in Fig. 4.

13. Reliability test items

| Test item | Conditions | | | | |
|-------------------------------|--|--|--|--|--|
| High temperature storage test | Ta=60°C 240h | | | | |
| | Ta=-25t 240h | | | | |
| | Ta=40°;95%RH 240h | | | | |
| | (No condensation) | | | | |
| | Ta=50t 240h | | | | |
| | Ta=0℃ 240h | | | | |
| | Frequency: 10-57Hz/Vibration width (one side): 0.075mm | | | | |
| | :58~500Hz/Gravity:9.8m/s ² | | | | |
| (N.O.) | Sweep time: 11 minutes | | | | |
| • | Test period: 3 hours | | | | |
| | (1 hour for each direction of X, Y, Z) | | | | |
| Shock test | Max. gravity: 490m/s ² | | | | |
| | Pulse width: 11ms. sine wave | | | | |
| | Direction: ±X, ±Y, ±Z | | | | |
| | once for each direction. | | | | |
| | High temperature storage test Low temperature storage test High temperature & high humidity operation test High temperature operation test Low temperature operation test Vibration test (non-operating) Shock test (non-operating) | | | | |

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function.

14. Others

i) Lot No. Label:



- 2) Adjusting volume have been set optimally before shipment, so do not change any adjusted value. If adjusted value is changed, the data mentioned in these specifications literature may not be satisfied.
- 3) Disassembling the module can cause permanent damage and should be strictly avoided.
- 4) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.
- 5) If any problem occures in relation to the description of these specifications literature it shall be resolved through discussion with spirit of cooperation.

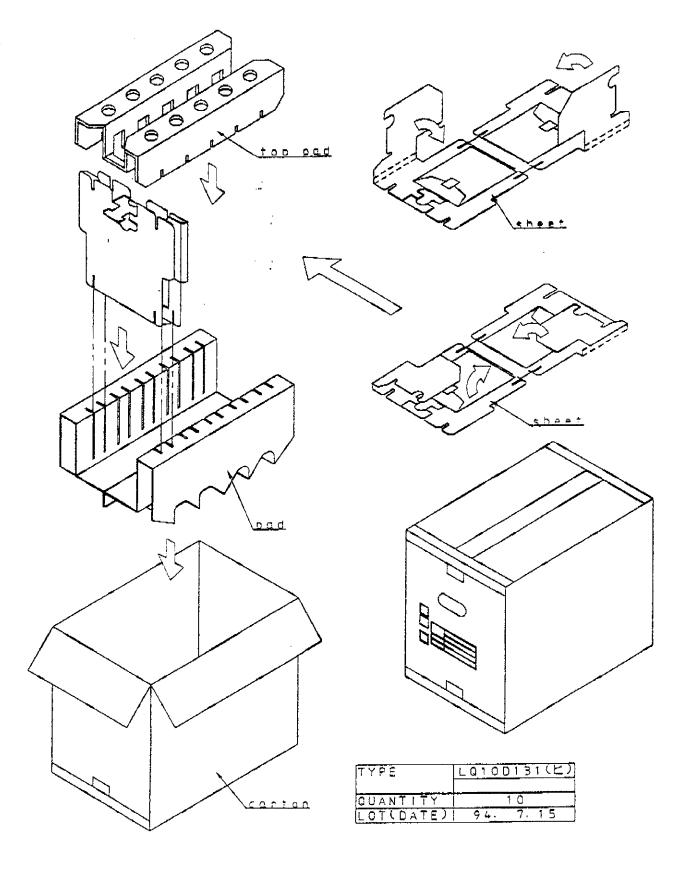
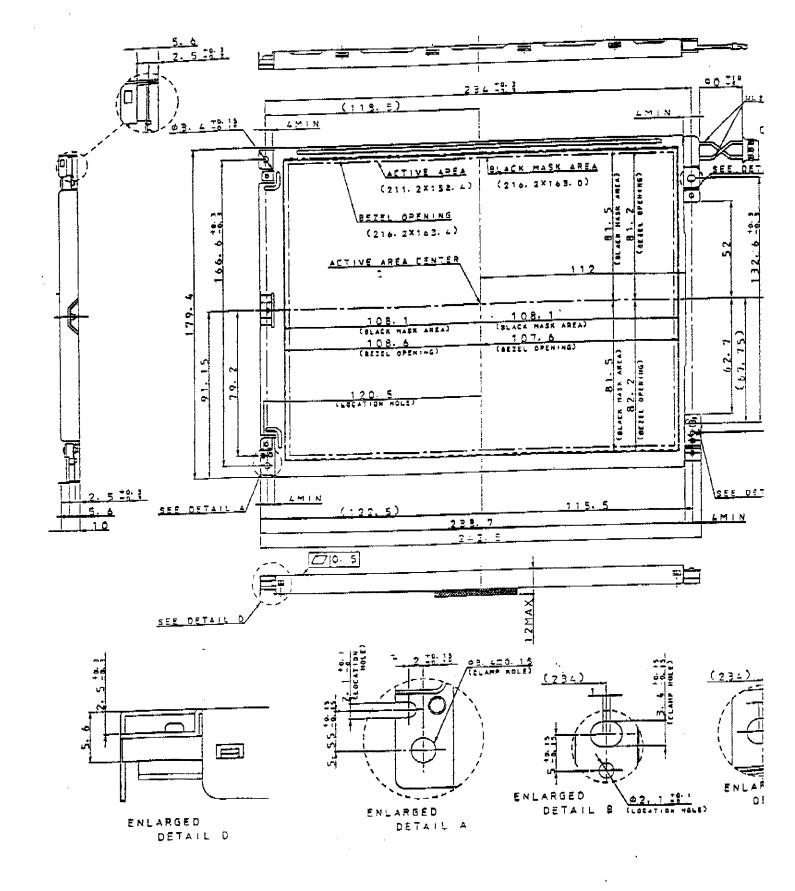
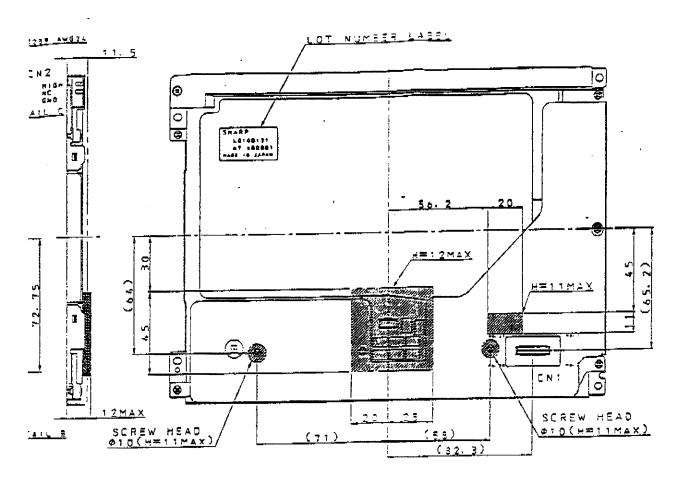
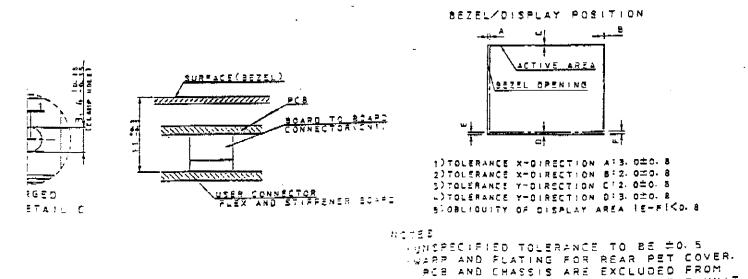


fig. 4 packing form







THICKNESS AND DIMENSION OF THE UNIT.